Old Spec Exam Questions MS

June 2008

Q	Solution	Marks	Total	Comments
1(a)	$s=\frac{1}{2}(3+10)\times 3$	M1		Finding distance by summing 3 areas or using formula for the area of a trapezium
		A1		Correct equation/3 correct expressions for the areas
	$=19.5$ m	A1	3	Correct total distance
(b)	$a=\frac{3}{4}=0.75$ ms^{-2}	B1	1	Correct acceleration as a decimal or as a fraction

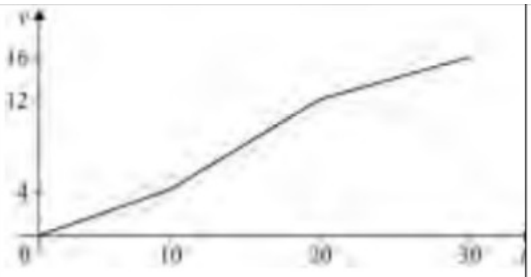
January 2011

2(a)	$s=\frac{1}{2}\times 10\times 4+10\times 4+\frac{1}{2}\times(4+7)\times 10+\frac{1}{2}\times 7\times 10$ $(=20+40+55+35)$ $=150$ m	M1M1A1 A1	4	M1: Any one term correct. M1: A second term correct. A1: Correct expression for total distance. A1: Total distance correct.
	OR $s=\frac{1}{2}\times(10+20)\times 4+\frac{1}{2}\times(4+7)\times 10+\frac{1}{2}\times 7\times 10$ $(=60+55+35)$ $=150$ m	(M1M1A1) (A1)		
	OR $s=\frac{1}{2}\times 10\times 4+10\times 4+10\times 4+\frac{1}{2}\times 10\times 3+\frac{1}{2}\times 7\times 10$ $(=20+40+40+15+35)$ $=150$ m	(M1M1A1) (A1)		
(b)	Average Speed $=\frac{150}{40}=3.75$ ms^{-1}	M1 A1F	2	M1: Their total distance divided by 40. A1F: Correct average speed based on their distance from part (a). Must be correct to three or more significant figures.
(c)	$a=\frac{4}{10}=0.4$ ms^{-2}	M1 A1	2	M1: Any division involving the numbers 10 and 4. A1: Correct acceleration. CAO **Note on use of constant acceleration equations:** award M1 for correct equation with correct values and A1 for correct final answer.

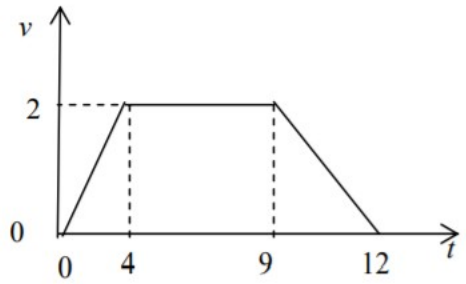
June 2013

2(a)	$s = \frac{1}{2}(5+4)\times 6 + \frac{1}{2}(4+7)\times 8 + 7\times 7$ $= 27 + 44 + 49$ $= 120$ m	M1A1 A1 A1	 4	M1: Method based on three (or four or more!) areas / distances or equivalent added together. A1: Correct calculation or value for one area / distance for one time period (eg 0 to 6 seconds). A1: Correct calculation or value for area / distance for another time period. A1: Correct final distance. For example 24 + 44 + 49 = 117 scores M1A1A1A0.
(b)	Average Speed $= \frac{120}{21} = 5.71\ \text{m s}^{-1}$	M1 A1F	2	M1: Their answer to part (a) divided by 21. A1F: Correct average speed. Accept $5\frac{5}{7}$ or $\frac{40}{7}$.
	Total		**6**	

January 2006

6(a)(i)		B1 B1 B1	 3	3 straight lines correct end points sensible scales + labelled *v*/*t*
(ii)	$s = \frac{1}{2}\times 10\times 4 + \frac{1}{2}\times(4+12)\times 10 +$ $\frac{1}{2}(12+16)\times 10$ $s = 240$ metres	M1 m1 A1 A1√	 4	area attempt / full method / equation correct Or equation attempted / full method / all correct √ one slip √ one slip
(iii)	Average speed $= \frac{240}{30}$ $= 8\,\text{m s}^{-1}$	M1 A1√	 2	√distance
(iv)	Greatest acceleration $= 2^{\text{nd}}$ stage $= \frac{12-4}{10}$ $= 0.8\,\text{m s}^{2}$	 M1 A1	 2	 cao

January 2007

2(a)		B1 B1 B1 B1	4	Starts and finishes at rest Correct shape Correct values on t-axis Correct values on v-axis Condone omission of the origin
(b)	$s=\frac{1}{2}(5+12)\times 2$ **or** $s=\frac{1}{2}\times 2\times 4+5\times 2+\frac{1}{2}\times 2\times 3=17$ $=17$	M1 A1	 2	Use of the area under the graph (or equivalent) to find s Correct distance **SC** When 21 used instead of 12 allow full marks for $s=26$

January 2009

2 (a)	$t=0,\ t=30,\ t=50$ seconds	B1 B1	 2	B1: Any one correct time B1: The other two correct times Deduct one mark for each extra time if more than three times are given. (eg 0, 15, 30, 50 scores B1B0) (eg 0, 15, 30, 40, 50 scores B0B0) Condone 49 or 48 instead of 50
(b)	$s_1=\frac{1}{2}\times 30\times 5=75$ m **AG**	M1 A1	 2	M1: Finding distance by calculation of area. (Must see use of 0.5 or ½) A1: Correct answer from correct working. (If candidates use two constant acceleration equations, both must be seen for the M1 mark.)
(c)	$s_2=\frac{1}{2}\times 4\times 20=40$ m	M1 A1		M1: Finding distance using area of the second triangle. A1: Correct distance (ignore any negative signs). (If candidates use two constant acceleration equations, both must be seen for the M1 mark.) Accept 38/36 from use of 49/48 instead of 50
	$s=75+40=115$ m	M1 A1F	 4	M1: Addition of the 75 metres and their distance. (75 – 40 = 35 OE scores M0) A1F: Correct result using their value for second area. eg Accept 113/111 from use of 49/48 instead of 50
(d)	$s=75-40=35$ m	M1 A1F	 2	M1: Difference between 75 and their value for the second distance. (Allow their distance – 75) (75 – (– 40) = 115 OE scores M0) A1F: Correct result using their value for second area. (eg 40 – 75 = –35 M1A0) eg Accept 37/39 from use of 49/48 instead of 50

June 2010

Q	Solution	Marks	Total	Comments
1(a)	30 seconds	B1	1	B1: Correct statement of time.
(b)	$s_1 = \frac{1}{2}\times 40\times 20 = 400$ m	M1 A1	2	M1: A method for calculating the first distance. Must see 40 and $\frac{1}{2}$. A1: Correct distance.
	OR			
	$s_1 = \frac{1}{2}\times(20+0)\times 40 = 400\,\text{m}$	(M1) (A1)		
	OR			
	$a = -\frac{20}{40} = -\frac{1}{2}$			Note on third method: Must see $-\frac{1}{2}$ or $-\frac{20}{40}$ plus attempt to find distance for M1.
	$0^2 = 20^2 + 2\left(-\frac{1}{2}\right)s$	(M1)		
	$s = 20^2 = 400$ m	(A1)		
(c)	$s_2 = \frac{1}{2}\times 50\times 20 = 500\,\text{m}$	M1		M1: Method for finding the second distance and calculating the total distance.
	OR			
	$s_2 = \frac{1}{2}\times(0+20)\times 50 = 500\,\text{m}$	(M1)		
	OR			
	$a = \frac{20}{50} = \frac{2}{5}$			
	$20^2 = 0^2 + 2\left(\frac{2}{5}\right)s$	(M1)		Note on third method: Must see $\frac{2}{5}$ or $\frac{20}{50}$ plus attempt to find distance.
	$s = 20^2 \times \frac{5}{4} = 500$ m			
	Total = 400 + 500 = 900 m	A1F	2	A1F: Correct total distance. Award the follow through mark for correct addition of 500 and their answer to (b).
(d)	$v_{AVERAGE} = \frac{900}{120} = 7.5\ \text{ms}^{-1}$	M1 A1F	2	M1: Their total distance divided by 120 A1F: Correct average speed based on their answer to (c).
(e)	$120\times 20 - 900 = 1500$ m	M1A1F	2	M1: Multiplication of 20 and 120 to find distance. Note: Award M1 if 2400 seen in this part. A1F: Correct difference based on their answer to (c) provided final answer is positive.
	Total		**9**	

January 2012

Q	Solution	Marks	Total	Comments
3(a)	$s_1 = \frac{1}{2} \times 5 \times 28 = 70$ m	M1A1	2	M1: For $\frac{1}{2} \times 5 \times 28$ or equivalent. A1: Correct distance.
(b)	$s = 70 + \frac{1}{2} \times 5 \times 22$ $= 70 + 55$ $= 125$ m	B1M1 A1F	3	B1: For $\pm\frac{1}{2} \times 5 \times 22$ or equivalent. M1: For adding the distances. A1F: Correct distance. Follow through their answer from part (a) only.
(c)	Average speed $= \frac{125}{50} = 2.5$ ms^{-1}	M1 A1F	2	M1: For their answer to (b) divided by 50. A1F: Correct average speed. Follow through answers from part (b).
(d)	Displacement from $O = 70 - 55$ $= 15$ m	B1	1	B1: Correct displacement.
(e)	Average velocity $= \frac{15}{50} = 0.3$ ms^{-1}	M1 A1F	2	M1: For their answer to (d) divided by 50, provided they have subtracted in (d). A1F: Correct average velocity. Follow through answers from part (d) Award no marks if the final answer is 0.
(f)	$a = \frac{5}{18} = 0.278$ ms^{-2}	B1	1	B1: Correct acceleration. Accept $\frac{5}{18}$ or equivalent fraction or 0.277 or AWRT 0.278. Condone 0.28
	Total		**11**	

AQA Topic Test MS

3 (a)(i)	x-axis labelled Time (s), y-axis labelled Speed (m s^{-1}) Straight lines from (0, 0) to (5, 10) to (17,10)	 1
	Total	**1**
3 (a)(ii)	Acceleration $= \frac{10}{5} = 2$ m s^{-2}	1 (using graph)
	Total	**1**
3 (a)(iii)	Distance travelled $= \frac{1}{2} \times 5 \times 10 + 12 \times 10$ $= 145$ m	1 (using graph) 1
	Total	**2**
3 (b)	x-axis labelled Time (s), y-axis labelled Distance (m) Increasing curve from (0, 0) to (5, 25) then straight line from (5, 25) to (17, 145)	 1 1
	Total	**2**

Integral Kinematics Topic Assessment MS

1. (i) $\text{Acceleration} = \dfrac{\text{change in velocity}}{\text{time taken}}$

$= \dfrac{10}{3}\ ms^{-2}$

[2]

(ii) Displacement = area under graph

$= \left(\frac{1}{2} \times 1 \times 10\right) + \left(\frac{1}{2} \times 3 \times (10 + 20)\right) + \left(\frac{1}{2} \times 2 \times 20\right)$

$= 70\ m$

[4]

(iii) Displacement between $t = 6$ and $t = 7$ is $\frac{1}{2} \times 1 \times -10 = -5$

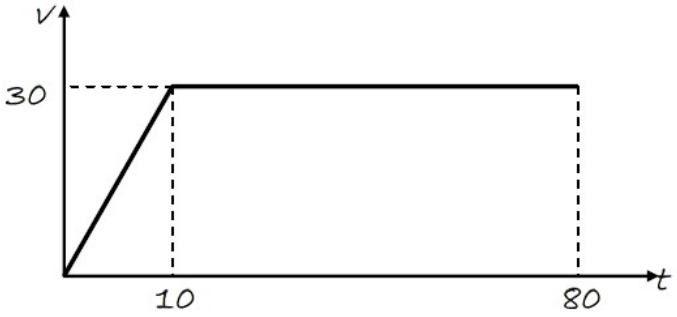
Displacement between $t = 0$ and $t = 7$ is $70 - 5 = 65\ m$.

[2]

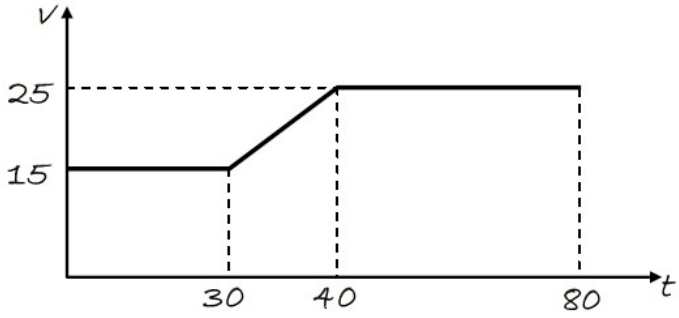
(iv) The particle decelerates at a constant rate of $10\ ms^{-2}$. When $t = 6$ the particle is instantaneously at rest and thereafter the particle is travelling in the opposite direction.

[2]

4. (i) Car A:



Car B:



[4]

(ii) In the first 10 seconds, car A travels $\frac{1}{2} \times 10 \times 30 = 150$ m.
In the next 30 seconds, car A travels $30 \times 30 = 900$ m.
Total distance travelled by A in the first 40 seconds = 1050 m.

In the first 30 seconds, car B travels $15 \times 30 = 450$ m.
In the next 10 seconds, car B travels $\frac{1}{2}(15 + 25) \times 10 = 200$ m.
Total distance travelled by B in the first 40 seconds = 650 m.

So in the first 40 seconds, extra distance travelled by car A
$= 1050 - 650 = 400$ m.

[4]

(iii) After the first 40 seconds, car A is 100 m behind car B.
At this point car A is travelling at 30 ms^{-1} and car B is travelling at 25 ms^{-1}.
Distance travelled by A in t seconds is $30t$, and distance travelled by B is $25t$.
When A catches up with B, $30t - 25t = 100$

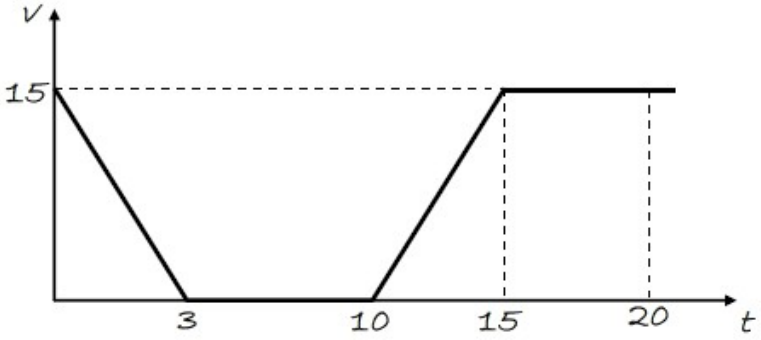
$$5t = 100$$

$$t = 20$$

so the extra time taken is 20 seconds.
So A catches up with B when $t = 60$.

[2]

6. (b) (i)



Distance travelled by car $= \frac{1}{2} \times 15 \times 3 + \frac{1}{2} \times 15 \times 5$

$$= 22.5 + 37.5$$

$$= 60$$

Distance travelled = 60 m.

[6]

(ii) Distance travelled by bus $= 20 \times 15 = 300$
Extra distance travelled by bus $= 300 - 60 = 240$ m.

[2]